

# Morfologia e Morfometria da Cérvix Uterina de Cabras Sem Raça Definida da Microrregião de Teresina-Piauí

## Morphology and Morphometry of the Uterine Cervix of Cross Breed Goat from Micro Region of Teresina-Piauí

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### Resumo

A criação de caprinos está em ascensão mundial. No Brasil, esta prática tem contribuído bastante na economia, principalmente da região Meio Norte, onde o clima predominante, o semiárido, é favorável à criação destes animais. As cabras sem raça definida (SRD) podem apresentar alterações morfofisiológicas adaptativas para viverem neste ambiente específico. As adaptações podem ocasionar modificações que fogem ao padrão geralmente observado. Na análise macroscópica foram observados trinta úteros de cabras SRD quanto a topografia, morfometria e quantificação dos anéis cervicais uterinos. Das estruturas analisadas, observaram-se diferenças apenas quanto ao número de anéis, quando comparados com outros pequenos ruminantes. A estrutura histológica da cérvix foi analisada em microscopia de luz. Este órgão é composto predominantemente por tecido conjuntivo, apresentando pouco tecido muscular. A luz do colo uterino é revestida por um epitélio pseudoestratificado com células caliciformes. A mucosa endocervical apresenta dobras longitudinais e é repleta de glândulas secretoras de muco. As camadas musculares encontram-se dispostas de forma circular (interna), longitudinal (externa) e com algumas fibras transversais. Assim, as características anatômicas da cérvix uterina de cabras sem raça definida são importantes para uma melhor execução das técnicas de manejo reprodutivo, bem como para biologia destes animais.

**Palavras-chave:** Reprodução. Morfologia. Ruminantes.

### Abstract

Goat farming is steadily increasing worldwide. In Brazil this practice have contributed a lot in the economy, especially the Mid-North region, where the semi-arid prevailing climate is favorable to the creation of these animals. To live in this environment, the cross breed goat may have morpho-physiological adaptive changes, which may cause changes that are beyond the pattern usually observed. Thirty cross breed goat uterus were selected for topographic and morphometric analysis and quantification of uteri cervical rings. In analyzed structures, differences were observed only on the number of rings when compared with others small ruminants. The histological structure of the cervix was examined under light microscopy. This body is predominately composed of connective tissue with little muscle tissue. The light of the cervix is lined by a pseudostratified epithelium with goblet cells. The endocervical mucosa has longitudinal folds and is lined with mucus-secreting glands. Muscle layers are arranged circular (internal), longitudinal (external) and some transverse fibers. Thereby, the anatomical characteristics of the uterine cervix of cross breed goats are important both to the improvement of the reproductive management techniques as to the biology of this animal.

**Keywords:** Reproduction. Morphology. Ruminants.

### 1 Introduction

The goat business has been intensified worldwide in the last decades and the interest for management of these animals is evident<sup>1</sup>. The caprine population of Brazil is estimated at 9,450,312 million goats, of which over 93% of this flock is concentrated in the Northeast region<sup>2</sup>. These data fortifies the goat rearing as a viable alternative to increase income and even fully supply the needs of disadvantaged social groups on that region. Though numerically significant, the production is extensive and, to a lesser degree, semi-intensive. The product has well established an economic, social and nutritional importance, supporting the

development of the country<sup>1,3,4</sup>.

Goats occur in various regions of the globe. For example, Saanen specimens are found in 81 countries<sup>5</sup>. Some animals of the Mid-North region of Brazil, including the micro region of Teresina, are considered cross breed goats, presenting characteristics of hardiness and adaptability to soil and climatic conditions, with such favoring good productive and reproductive performance on the semi-arid northeastern<sup>6</sup>. The adaptability of Saanen goats in this environment is reflected from adaptations in diet to morpho-physiological changes that provide greater reproductive success, as has been observed<sup>7-9</sup>.

The study of morpho-physiological changes is important once it facilitates the flock nutritional and reproductive management on this region. Depending of the climate, these adaptations may induce reproductive aspects such as gestational periods, production of gametes and oocytes fertilization<sup>7-10</sup>.

Knowledge about goat biology is needed in order to intensify production, assisting sheep producers to effectively supply a domestic and possibly external trade demand. Information such as reproductive period, reproductive behavior and morphology of the genital systems are of significant importance.

The study of the reproductive system of goats in Mid-North of Brazil is indispensable to know this specie on specific environment. The female reproductive organs mainly the uterus are responsible for oocyte fertilization and gestation maintenance. Contributing studies to the understanding of this process have been described elsewhere<sup>11-14</sup>. Thus, goats raised in the semi-arid region have morpho-physiological singularities<sup>9</sup> that may also be reflected on female genital tract.

The organs of this system are well defined, as well as the specific functions within the reproductive process. In this context, the cervix performs a key role to the success of fertilization and therefore reproduction. The size and shape of the cervix and its tortuous cervical canal are barriers to reproductive interventions, such as artificial insemination<sup>15</sup>. Thus, cervical anatomy is a relevant aspect for both breeders seeking accuracy in techniques, aiming cost reduction and improved performance, as well as for the actual biology of the animal.

A thick body wall, with a slight constriction forms a canal with several prominences. Their morphology is functionally designed to select and store viable sperm, working as a selective barrier against infection. Besides the selectivity, the cervix is responsible for the production of mucus, which interferes with sperm transit to the site of fertilization<sup>16,17</sup>. Thus, the detailed characterization of the cervix is important to intervene successfully on reproduction.

Many work related to biotechnology of reproduction and the reproductive cycle of goats have been performed<sup>18-22</sup>. However, researches on the morphology of the genital system of these animals, particularly the cervix, are not found in the literature. Then, considering the importance of the uterine cervix, especially in biotechnological manipulations such as artificial insemination, morphological characteristics of this organ are required, both macro and microscopically. Studies on the morphology of the uterus and cervix of cross breed goats, despite the importance of these animals on the national scene are not observed. This study describes the morphology and morphometry of the uterine cervix of

cross breed goat of the Mid-North of Brazil, focusing on the number of cervical rings.

## 2 Material and Methods

Thirty-three uteri from cross breed goats aged eight months and weighing on average 41kg were used, obtained from local slaughterhouses in the city of Teresina, Piauí. This procedure was referred to the Ethics Committee of State University of Piauí (Nº 009/2010).

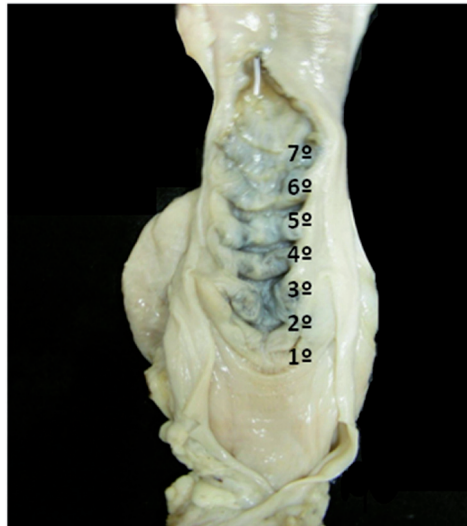
Thirty organs were analyzed for anatomic study of the cervix, including cervical rings quantification and morphometry. The topographic aspects were observed yet in the slaughterhouses during slaughter and opening the abdominal cavity. After the slaughter, the uteri were collected, washed with water at 40 °C and taken to the Histology and Embryology laboratory of the Federal University of Piauí. Then, dissection and analysis of the cervix anatomic aspects were carried out, as well as cervical ring quantification, caudally to cranially. The cervix morphometry was performed in accordance to Mandarin de Lacerda<sup>23</sup> methods, where a caliper was used to scale the measure of rectilinear and other measures were obtained with the help of a cotton thread placed in the organ. The results were photographed (SONY/DSC\_H50).

Three organs were used for light microscopy. The cervix components were dissected immediately after slaughter and cut in 0.5 cm thick segments with regions extending from the mucosal to the serosal lining of the cervix in three portions (cranial, middle and caudal). The ring fragments were washed with 40 °C water and fixated by immersion in 10% formalin solution buffered with potassium hydroxide (pH around 7.0) for at least 48h. Following fixation, the fragments were taken to the usual histological routine for light microscopy, consisting of dehydration, diaphanization, impregnation with paraffin wax, blocking, microtomy and deparaffinization. Finally the fragments were stained with hematoxylin and eosin for histological evidence of the constitution. The materials were analyzed by light microscopy (OLYMPUS) and documented in photomicrographs.

## 3 Results and Discussion

The goat uterus is located on the pelvic cavity, dorsal to the urinary vesicle and is limited sideways by broad ligaments which communicate with the ovaries. It presents cornual form and occupies small space on the cavity in the animal not pregnant.

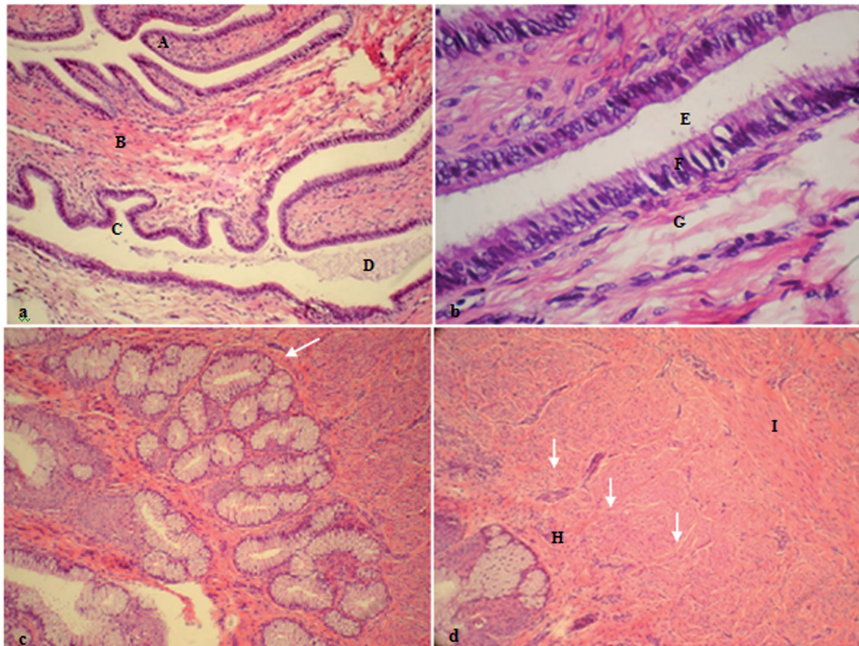
Morphometrically, the cervixes were 5.42 cm ( $\pm$  0.17) long, 1.52 cm ( $\pm$  0.04) wide and 4.90 cm ( $\pm$  0.09) around. Cross breed goats studied had, on average, 7 cervical rings (Figure 1) that obliterated the cervix partially.



**Figure 1:** Uterine cervix of cross breed goats created in Half North of Brazil, showing the cervical rings, numbered in ascending order the fornix to the uterus. There is a total of seven rings, the first being the fornix (caudal) and the last for the protrusion of the cervix (cranial end).

In Figure 2a we can observe the projections of irregular endocervical mucosa (A) facing the light of the cervical canal; the dense connective tissue not modeled (B), which provides

protection and a certain resistance to the organ. There is also the covering epithelium (C) and mucus (D) produced by mucus-secreting cells.



**Figure 2:** Photomicrographs of histological sections of the uterine cervix of cross breed goats stained with HE. (a) There are irregular projections of endocervical mucosa (A) to the light of the cervical channel; connective tissue dense not modeled (B), epithelium (C) and mucus (D). Increase 100 x. (b) Light of the cervix (E), mucosa (F), consisting pseudostratified ciliated epithelium with goblet cells and the lamina propria mucosae (G) consists of loose connective tissue. Increase 400 x. (c) Mucus-secreting glands in the submucosa (arrow). Increase 100 x. (d) two layers of smooth muscle cells, evidenced by inner circular muscle fibers (H), muscles fibres outside formed by longitudinal fibres (I) and transversal fibres (arrows). Increase 50 x.

In Figure 2b we can see the light of the cervix (E), the mucosal region (F) formed by pseudostratified epithelium with goblet cells, and the lamina propria mucosae (G) consisting of loose connective tissue. As well as the mucosal

region mucus-producer, the submucosa has mucus-secreting glands in abundance, as observed in Figure 2c (arrow).

In Figure 2d we observe the layers of smooth muscle cells, as evidenced by internal circular muscular fibers (H), external

muscle formed by longitudinal fibers (I), and transverse fibers indicated by arrows.

The goat cervix, similar to that of the sheep, has several folds and rings. Those are arranged from the caudal region, forming a protrusion into the uterine body to the cranial region near the fornix of the vagina, the largest and most misaligned<sup>24</sup>. The cervix is clearly demarcated from the body of the uterus and vagina, so that the internal and external ostium is quite distinct<sup>25</sup>.

The cervix lumen is very twisted and tortuous due to the presence of rings, usually 4 to 7<sup>26</sup>. These reciprocal prominences and depressions of the mucosa hinder the expansion of this region<sup>24</sup>. On the other hand, the rings' conformation forms an obstruction between the uterus and vagina, acting as a barrier against external contaminants or infections<sup>17,26</sup>.

According to Smith and Sherman<sup>10</sup>, the number of cervical rings in small ruminants (ewe, deer, elk, llamas) is approximately five. In our study, the animals showed a greater number of rings, but some factors may explain this difference. First, the morphology of the cervix may vary between races and according to the animal's age<sup>27</sup>. Moreover, climatic factors may also influence the morphological conformation of some organs. A research with male goats in warm climates showed small morphological changes in the genital organs of these animals<sup>7,28</sup>. Thus, it is inferred that there may be an influence of climatic factors on the morphology of uterine cervix of goats raised in the micro region of Teresina, on Mid-North Brazil, where the climate is semi arid.

The histological structure of the cervix differs from other regions of the uterus, consisting predominantly of connective tissue and showing little muscle tissue<sup>16,17</sup>. The outer portion of this region that bulge into the lumen of the vagina is lined by stratified squamous epithelium<sup>29</sup>. The functional characteristics of the cervix can be dramatically altered by changes in concentration and interaction of molecules that compose the extracellular matrix of the connective tissue<sup>16</sup>.

According to Bracha and Bracha<sup>30</sup>, the longitudinal folds found in the endocervical mucosa can be subdivided into secondary and tertiary folds. According to Banks<sup>31</sup>, the wall of the cervix is well developed and rich in mucus-secreting glands.

The epithelium of the cervical canal of large ruminants is mainly composed of goblet cells, occurring prismatic ciliated cells in some species. The lamina propria submucosa can diversify of dense connective tissue during the various stages of the estrous cycle<sup>31</sup>.

Cervical secretions have an important role in fertilization. During ovulation, the mucous secretions are more fluid in order to facilitate penetration of sperm into the uterus. During the luteal phase or pregnancy, progesterone levels alter the mucus secretions, so that they become more viscous, preventing the passage of sperm as well as the entry of microorganisms into the uterus<sup>16</sup>.

According to Junqueira and Carneiro<sup>29</sup>, the cervix has few smooth muscle fibers and consists mainly of dense connective

tissue. The muscle structure observed in this study is confirmed by Bracha and Bracha<sup>30</sup>, which describes the muscular layer as an inner circular layer and outer longitudinal smooth muscle.

#### 4 Conclusion

The cross breed goats created in the micro region of Teresina-Piauí, Mid-North of Brazil have some morphological characteristics that resemble those of races from other regions. A small difference in the number of uteri cervical rings was observed and can be explained by factors such as age and climate in which those animals were raised. Regarding the microscopic anatomy of the uterine cervix, there were no changes between the animals studied and others. Therefore, the results give us new data to enforce in studies of reproduction and management in goats.

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